

I. Objection To The Description of the Drawings

In the Office Action, the Examiner objected to the description of Figures 10, 12, 14, 19, 23, 24, and 25, as this description did not mention that each of these drawings appears on two separate sheets. In this Amendment, applicants have amended the Brief Description of the drawings to state that each of these drawings appears on two separate sheets. For instance, the brief description of Figure 10 now states: "Figure 10, which is presented on two separate sheets labeled Figure 10A and 10B, ..." The descriptions of Figures 12, 14, 19, 23, 24, and 25 include similar annotations. Applicants respectfully request reconsideration and withdrawal of the objection to the description of the drawings.

II. Rejection of the Claims Under 35 U.S.C. § 102

The Examiner also rejected claims 1, 2, 14-23, 31-36, 41-45, 48, 49, 52-57 as being anticipated under 35 U.S.C. § 102 by USP 5,973,376 issued to Rostoker et al (Rostoker). In this Amendment, Applicants have canceled claims 1-3, 14-42, and 65-87.

Applicants have re-written claim 4 into an independent claim with all the limitations of canceled claim 1, on which claim 4 originally depended. Applicants note that the Examiner deemed claims 4-13 allowable in the Office Action. Applicants further note that the Examiner also deemed claims 58-64 allowable in the Office Action. Accordingly, Applicants request allowance of these claims at the earliest possible date.

Applicants respectfully traverse the Examiner's rejection of claims 43-45, 48, 49, and 52-57. The Examiner rejected claims 43-45, 48, 49, and 52-57 as being anticipated by Rostoker. Applicants respectfully submit that Rostoker does not anticipate any of these claims. These claims recite a method that places circuit modules by constructing a connection graph with at least one edge that is at least partially diagonal. Rostoker does not disclose, teach, or even suggest such a method. To clarify this distinction further, Applicants have amended the body of

independent claim 43, on which rejected claims 44, 45, 48, 49, and 52-57 depend, to recite "identifying a placement metric based on the connection graph" with the at least one edge that is at least partially diagonal. In view of this amendment and the foregoing remarks, Applicants respectfully request reconsideration and withdrawal of the § 102 rejection of claims 43-45, 48, 49, and 52-57.

CONCLUSION

In view of the foregoing, it is submitted that the currently pending claims, namely claims 3-13, 43-64, and 88-96, are in condition for allowance. Reconsideration of the rejections and objections is requested. Allowance is earnestly solicited at the earliest possible date.

Respectfully submitted,

Dated: 3/6/03

STATTLER, JOHANSEN & ADELI LLP


Mani Adeli

Reg. No. 39,585

Stattler Johansen & Adeli LLP
PO Box 51860
Palo Alto, CA 94303-0728
Phone: (650) 752-0990 ext.102
Fax: (650) 752-0995



AMENDED PARAGRAPHS FOR REPLACEMENT IN THE SPECIFICATION

The following pages provide the amended paragraphs for the specification with the amendments marked with deleted material in [brackets] and new material underlined to show the changes made.

--Figure 10, which is presented on two separate sheets labeled Figure 10A and 10B, illustrates a process for generating a wirelength estimate according to a bounding-box method of the invention.--

Please replace the paragraph on page 11, lines 8-9 in the specification with the following amended paragraph.

--Figure 12, which is presented on two separate sheets labeled Figure 12A and 12B, illustrates a process for generating a wirelength estimate by constructing MST's that include horizontal, vertical, and 45° edges.--

Please replace the paragraph on page 11, lines 12-13 in the specification with the following amended paragraph.

--Figure 14, which is presented on two separate sheets labeled Figure 14A and 14B, illustrates a process for generating a wirelength estimate by constructing Steiner trees with 45° diagonal edges.--

Please replace the paragraph on page 12, lines 3-4 in the specification with the following amended paragraph.

--Figure 19, which is presented on two separate sheets labeled Figure 19A and 19B, illustrates a process that generates a congestion cost estimate, and partitions a set of nets, about a cut line.--

Please replace the paragraph on page 12, line 6 in the specification with the following

amended paragraph.

--Figure 23, which is presented on two separate sheets labeled **Figure 23A** and **23B**,
illustrates one example of a local optimization process.--

Please replace the paragraph on page 12, line 7 in the specification with the following
amended paragraph.

--Figure 24, which is presented on two separate sheets labeled **Figure 24A** and **24B**,
illustrates one example of a simulated annealing process.--

Please replace the paragraph on page 12, line 8 in the specification with the following
amended paragraph.

--Figure 25, which is presented on two separate sheets labeled **Figure 25A** and **25B**,
illustrates one example of a KLFM process.—

THE AMENDED CLAIMS

The following pages provide the amended claims with the amendments marked with deleted material in [brackets] and new material underlined to show the changes made.

4. [The method of claim 1, wherein the IC layout has a number of circuit elements, a net having a set of circuit elements,] For an electronic design automation application, a method of placing circuit modules in an integrated circuit ("IC") layout, wherein the IC layout has a number of circuit elements, a net having a set of circuit elements, the method comprising:

using a diagonal line to measure a placement metric;

wherein using the diagonal line to measure a placement metric comprises calculating an estimate of the length of interconnect lines necessary to connect the circuit elements of said net, wherein the calculation measures the length of at least one line that is at least partially diagonal.

43. For an electronic design automation application, a method of placing circuit modules in an integrated circuit ("IC") layout, wherein said IC layout includes a net and a plurality of circuit elements, wherein the net represents interconnections between a set of circuit elements, the method comprising:

constructing a connection graph that models the topology of interconnect lines for connecting the circuit elements of the net, said connection graph having edges, each edge connecting two circuit elements of the net, wherein at least one of the edges is at least partially diagonal;

identifying a placement metric based on the connection graph.

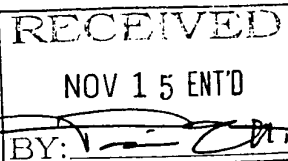


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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/731,891	12/06/2000	Steven Teig	SPLX.P0002	1036

23349 7590 11/06/2002
STATTLER JOHANSEN & ADELI
P O BOX 51860
PALO ALTO, CA 94303



EXAMINER

DO, THUAN V

ART UNIT PAPER NUMBER

2825

DATE MAILED: 11/06/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

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Office Action Summary

MAR 21 2003

Application No.

09/731,891

Applicant(s)

TEIG ET AL.

Examiner

Thuan Do

Art Unit

2825

-- The MAILING DATE of this communication appears on the cover sheet with the corresponding address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-87 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 58-87 is/are allowed.
- 6) ☒ Claim(s) 1,2,14-23,31-36,41-45,48,49 and 52-57 is/are rejected.
- 7) ☒ Claim(s) 3-13,24-30,37-40,46,47,50 and 51 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

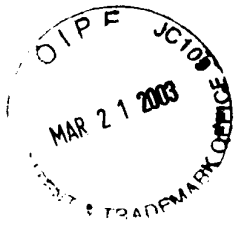
- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
b) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

as Cited (PTO-892)
Person's Patent Drawing Review (PTO-948)
Priority Statement(s) (PTO-1449) Paper No(s) ____

- 4) ☐ Interview Summary (PTO-413) Paper No(s) ____
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

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Art Unit: 2825



DETAILED ACTION

Claims 1-87 are pending in this office action.

Specifications

Figures 10A, 10B, 12A, 12B, 14A, 14B, 19A, 19B, 23A, 23B, 24A, 24B, 25A, and 25B are not specified in the specification section. Correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1,2,14-23,31-36,41-45,48,49,52-57 are rejected under 35 U.S.C. 102(b) as being unpatentable over Rostoker et al., Pat. No. 5,973,376.

Regarding claim 1: Rostoker teaches a method comprising:

For an electronic design automation application (col. 6, lines 7-30 describing semiconductor device design using computer aid design CAD) , a method of placing circuit modules in an integrated circuit ("IC") layout (col. 52, lines 9-24 using cell placement in the circuit layout) , the method comprising using a diagonal line (col. 81, lines 1-9 using diagonal interconnect line) to measure a placement metric (as described by different cost calculation functions in the specification , page 4, that is matched in col. 86, lines 1-7 by using optimized functions to get a cost factor).

Regarding claim 2: Rostoker teaches a method with measure congestion (col. 1, lines 46-55 where the wire length and interconnect congestion are minimized).

Regarding claim 14: Rostoker teaches for an electronic design automation application (col. 6, lines 7-30 describing semiconductor device design using computer aid design CAD) , a method of placing circuit elements in an integrated circuit layout (col. 52, lines 9-24 using cell placement in the circuit layout) , said layout using a wiring

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model that includes Manhattan and diagonal lines (col. 4, lines 54-60), the method comprising using a diagonal line (col. 81, lines 1-9 using diagonal interconnect line) to measure a cost of a placement configuration (as described by different cost calculation functions in the specification, page 4, that is matched in col. 86, lines 1-7 using optimized functions to get a cost factor).

Regarding claim 15: Rostoker teaches a method with measure congestion (col. 1, lines 46-55 where the wire length and interconnect congestion are minimized).

Regarding claim 16: Rostoker teaches a method with placement cost (col. 86, lines 1-7).

Regarding claims 17,20: Rostoker teaches a method with:

a) modifying the position (col. 45, lines 35-42 where the placement is replace by a new placement);

b) measure placement cost after modification (col. 45, lines 35-42 where the shuffled placement is performed after the change in cost is evaluated).

Regarding claim 18: Rostoker teaches a method with Manhattan lines and diagonal lines (col. 4, lines 54-60).

Regarding claim 19: Rostoker teaches a method with placement cost (col. 86, lines 1-7).

Regarding claims 21,22: Rostoker teaches a method with pins of circuit module (col. 58, lines 22-34).

Regarding claim 23: Rostoker teaches a method comprising:

a) constructing a bounding box that encompasses the circuit elements of the net (Figure 93B bounded box by three side edges 4252, 4254 and 4256 containing circuit elements); and

b) using a diagonal line to measure an attribute (line) of the bounding box (col. 16, lines 42-49 using an orthogonal coordinate line system for the bounding box) .

Regarding claim 31: Rostoker teaches a method with 45 degrees (col. 81, lines 1-9).

Regarding claim 32: Rostoker teaches a method with 120 degrees (col. 17, lines 7-15).

Regarding claims 33,34: Rostoker teaches a method with pins of circuit module (col. 58, lines 22-34).

Regarding claim 35: Rostoker teaches a method comprising:

a) for each particular net, constructing a bounding box that encompasses the circuit elements of the particular net (col. 16, lines 42-49 using an orthogonal coordinate system for the bounding box net elements) ;

b) for each particular bounding box, measuring an attribute of the particular bounding box, wherein the method uses diagonal lines to measure the attributes of some of the constructed bounding boxes (col. 16, lines 42-49 using an orthogonal coordinate system for the attribute line of bounding box elements); and

c) combining said attribute measurements to obtain an estimate of interconnect-line length necessary to connect the circuit elements of the nets in the IC layout (col. 83, lines 20-33 using various combinations of edge line attribute elements in the cell net circuit) .

Regarding claim 36: Rostoker teaches a method with adding measurements (col. 56, lines 8-16 by adding connection lengths together) .

Regarding claims 41,42: Rostoker teaches a method with pins of circuit module (col. 58, lines 22-34).

Regarding claim 43: Rostoker teaches a method comprising:

constructing a connection graph that models the topology of interconnect lines for connecting the circuit elements of the net (figure 6 display a graph for interconnect wires in circuit elements),

said connection graph having edges, each edge connecting two circuit elements of the net (col. 60, lines 1-9 for connection of edges using graph) , wherein at least one of the edges is at least partially diagonal (figure 8 for diagonal connection) .

Regarding claim 44: Rostoker teaches a method with calculation of length and edges and their combinations layout (col. 83, lines 20-33 using various combinations of edge line attribute elements in the cell net circuit) .

Regarding claim 45: Rostoker teaches a method with adding measurements (col. 56, lines 8-16 by adding connection lengths together) .

Regarding claim 48: Rostoker teaches a method with the combined length calculation provides an estimate of interconnect-line length needed to connect the circuit elements of the net (col. 56, lines 8-16 where the repeating process can provide the estimation the length until the total length completed).

Regarding claim 49: Rostoker teaches a method with placement cost (col. 86, lines 1-7).

Regarding claim 52: Rostoker teaches a method with 45 degrees (col. 81, lines 1-9).

Regarding claim 53: Rostoker teaches a method with 120 degrees (col. 17, lines 7-15).

Regarding claims 54,55: Rostoker teaches a method with pins of circuit module (col. 58, lines 22-34).

Regarding claim 56: Rostoker teaches a method with connection graph (figure 6) and a minimum spanning tree (col. 58, lines 60-67).

Regarding claim 57: Rostoker teaches a method with a Steiner tree (col. 59, lines 41-51).

Allowable Subject Matter

3. Claims 3,4-13,24-30,37-40,46-47,50,51 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The reason for allowance of claim 3: The prior art of record fails to teach measuring the number of nets that have circuit elements in both the sub-regions created by the diagonal cut line.

The reason for allowance of claims 4-13,24-30,37-40,51: The prior art of record fails to teach measurement of the length of at least one line that is at least partially diagonal.

The reason for allowance of claims 46-47,50: The prior art of record fails to teach calculating the distance (D).

Allowable Subject Matter

4. Claims 58-87 are allowed.

The reason for allowance of claims 58-64: The prior art of record fails to teach partially diagonal in combination with other features of independent claims.

The reason for allowance of claims 65-78: The prior art of record fails to teach measuring the number of nets that have circuit elements in both the sub-regions created by the diagonal cut line in combination with other features of independent claim.

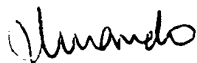
The reason for allowance of claims 79-87: The prior art of record fails to teach changing the positions of the circuit modules between the sub regions to minimize the number of nets intersected by the diagonal cut line in combination with other features of independent claim.

CONTACT INFORMATION

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thuan Do whose telephone number is 703-305-2362. The examiner can normally be reached on Monday-Friday 7:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew S. Smith can be reached on 703-308-1323. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9318 for regular and (703) 872-9318 after final communication.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0596.



Thuan Do
Patent examiner
10/28/02

9/731891

NOTICE OF DRAFTSPERSON'S
PATENT DRAWING REVIEW

The drawing(s) filed (insert date) 12/6/01 are:

A. ☐ approved by the Draftsperson under 37 CFR 1.84 or 1.152.B. ☒ objected to by the Draftsperson under 37 CFR 1.84 or 1.152 for the reasons indicated below. The Examiner will require submission of new, corrected drawings when necessary. Corrected drawing must be submitted according to the instructions on the back of this notice.1. DRAWINGS. 37 CFR 1.84(a): Acceptable categories of drawings:
Black ink. Color.☐ Color drawings are not acceptable until petition is granted.

Fig(s) _____

☐ Pencil and non black ink not permitted. Fig(s) _____

2. PHOTOGRAPHS. 37 CFR 1.84(b)

☐ 1 full-tone set is required. Fig(s) _____☐ Photographs may not be mounted. 37 CFR 1.84(c)☐ Poor quality (half-tone). Fig(s) _____

3. TYPE OF PAPER. 37 CFR 1.84(e)

☐ Paper not flexible, strong, white, and durable.

Fig(s) _____

☐ Erasures, alterations, overwritings, interlineations,

folds, copy machine marks not accepted. Fig(s) _____

☐ Mylar, velum paper is not acceptable (too thin).

Fig(s) _____

4. SIZE OF PAPER. 37 CFR 1.84(f): Acceptable sizes:

☐ 21.0 cm by 29.7 cm (DIN size A4)☐ 21.6 cm by 27.9 cm (8 1/2 x 11 inches)☐ All drawing sheets not the same size.

Sheet(s) _____

☐ Drawings sheets not an acceptable size. Fig(s) _____

5. MARGINS. 37 CFR 1.84(g): Acceptable margins:

Top 2.5 cm Left 2.5 cm Right 1.5 cm Bottom 1.0 cm

SIZE: A4 Size

Top 2.5 cm Left 2.5 cm Right 1.5 cm Bottom 1.0 cm

SIZE: 8 1/2 x 11

Margins not acceptable. Fig(s) _____

☐ Top (T) _____ Left (L)☐ Right (R) _____ Bottom (B)

6. VIEWS. 37 CFR 1.84(h)

REMINDER: Specification may require revision to correspond to drawing changes.

Partial views. 37 CFR 1.84(h)(2)

☐ Brackets needed to show figure as one only.

Fig(s) _____

Views not labeled separately or properly.

8. ARRANGEMENT OF VIEWS. 37 CFR 1.84(i)

☐ Words do not appear on a horizontal, left-to-right fashion when page is either upright or turned so that the top becomes the right side, except for graphs. Fig(s) _____

9. SCALE. 37 CFR 1.84(k)

☐ Scale not large enough to show mechanism without crowding when drawing is reduced in size to two-thirds in reproduction.

Fig(s) _____

10. CHARACTER OF LINES, NUMBERS, & LETTERS.

37 CFR 1.84(i)

☐ Lines, numbers & letters not uniformly thick and well defined, clean, durable, and black (poor line quality).

Fig(s) _____

11. SHADING. 37 CFR 1.84(m)

☐ Solid black areas pale. Fig(s) _____☐ Solid black shading not permitted. Fig(s) _____☐ Shade lines, pale, rough and blurred. Fig(s) _____

12. NUMBERS, LETTERS, & REFERENCE CHARACTERS.

37 CFR 1.84(p)

☐ Numbers and reference characters not plain and legible.

Fig(s) _____

☐ Figure legends are poor. Fig(s) _____☐ Numbers and reference characters not oriented in the same direction as the view. 37 CFR 1.84(p)(1)

Fig(s) _____

☐ English alphabet not used. 37 CFR 1.84(p)(2)

Figs _____

☐ Numbers, letters and reference characters must be at least .32 cm (.8 inch) in height. 37 CFR 1.84(p)(3)

Fig(s) _____

13. LEAD LINES. 37 CFR 1.84(q)

☐ Lead lines cross each other. Fig(s) _____☐ Lead lines missing. Fig(s) _____

14. NUMBERING OF SHEETS OF DRAWINGS. 37 CFR 1.84(t)

☐ Sheets not numbered consecutively, and in Arabic numerals beginning with number 1. Sheet(s) _____

15. NUMBERING OF VIEWS. 37 CFR 1.84(u)